the figures of the general appearance are good, but the sketches of details, as, for instance, the utricles, are too small to help much in determination of species. They would be more satisfactory if they were drawn natural size or larger. The book is written in English.

An Arithmetic for Schools. By J. P. Kirkman, M.A., and A. E. Field, M.A. Pp. lxvi + 492. (London: Edward Arnold, n.d.) Price 3*s.* 6*d.*

THE distinguishing characteristics of this book are simplicity and great clearness of exposition. The first two chapters deal mainly with our terrible English system of weights and measures, and in this lawless region no skill on the part of an author can be of service to the beginner. Once this tangled wilderness is passed, however, the skill of the authors in exposition comes into play. The treatment of common measures and multiples and the various rules for ascertaining rapidly whether a given number is or is not divisible by specified numbers are very clearly and successfully explained. The philosophy of the rules for the division and multiplication of vulgar fractions is very plainly set forth, and the rules for the contracted multiplication and division of decimals are well explained and illustrated near the end of the book. We have also an account of the metric system, followed by numerous examples of "practice." After this we have the calculation of areas and volumes, and an adequate exposition of the method of extracting square and cube roots. This is followed by the treatment of interest, stocks, and the various branches of the subject which are found in all arithmetical treatises, and then comes an enormous collection of examples. An appendix explaining and illustrating the use of squared paper for the comparison of scales and other kinds of calculation forms a useful and interesting conclusion.

The work is one which can be very confidently recommended to all teachers and students of arithmetic.

A First Step in Arithmetic. By J. G. Bradshaw, B.A. Pp. vi + 166. (London: Macmillan and Co., Ltd., 1902.) Price 2*s.*

ONLY the first four rules, simple and compound, are covered by this book, but the exercises upon them have been so carefully selected and arranged that children who receive instruction through them will acquire an intelligent and working knowledge of simple arithmetic. The exercises are arranged for both oral and paper work, and there is no doubt that the combination of the two methods of teaching the subject gives the best educational result. In most text-books of arithmetic, the pupils are discouraged at the outset by exercises and problems beyond their comprehension, but Mr. Bradshaw deals with amounts which beginners will have no difficulty in grasping and will work out successfully. An essay containing hints on methods of presenting the early rules of arithmetic, which occupies the first twenty-nine pages, contains some notes of service to inexperienced teachers of children; but they are out of place in a pupil's book, and belong rather to a volume on the practice of teaching.

The Real Origin of Religion. By Jabelon. Pp. 48. (London: Simpkin, Marshall and Co., Ltd., 1902.)

THE object of this pamphlet is to establish the not very novel or fortunate hypothesis of the phallic origin of all religious symbolism. The proofs offered are of three kinds, none of which possesses any real cogency. Certain savage tribes attach great importance to circumcision and other mutilations of the sexual organs, the reason for which is unknown. Therefore, the author argues, *all* primitive ceremonialism must be of sexual significance. This conclusion is supported by a number of etymologies, all unscientific and demonstrably false, and by an obscurely worded attempt to interpret the vision of Ezekiel as an account of the anatomical structure of the brain. The scientific value of the farrago is precisely *nil.*

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

Re Vegetable Electricity.

I AM reluctantly obliged to traverse a statement made by Prof. J. C. Bose (in the *Journal* of the Linnean Society of July 21, p. 304, footnote) to the effect that "Dr. Waller has subsequently been able to confirm the results which he (Dr. W.) heard me describe on the occasions referred to (Royal Institution, May 10, 1901; Royal Society, June 6, 1901).

I am compelled to state that Prof. Bose, previously to these dates, visited my laboratory on several occasions, received every facility that I was able to afford him as regards the methods by which I was and am investigating the physiological properties of animal and vegetable protoplasm, and *inter alia* heard from me, and has doubtless forgotten, the statement that the electrical response of plants is a general property of vegetable protoplasm, and not confined to such plants (dionæa, mimosa, &c.) as exhibit obvious movements.

Prof. Bose obtained (with my full approval) from my laboratory-mechanic the principal instruments used by me in such investigations, has imitated some of my experiments, and has gradually adopted their guiding theory. He is not entitled to make the statement quoted above.

AUGUSTUS D. WALLER.

P.S.—In connection with this subject of vegetable electricity I may take this opportunity of commenting upon two series of observations that have been made in Germany in contradiction of some of my principal conclusions.

Prof. Adami, of Hof, quotes from the German translation of 1899 of my "Lectures on Animal Electricity," published in 1898, the following passage:—"Verbindet man zwei Punkte A und B der unverletzten Kartoffel mit dem Galvanometer, so lässt sich kein merklicher Strom nachweisen; sobald aber die Kartoffel an einem Punkte B durch einen Messerschnitt verletzt wird, schlägt der Lichtfleck nach rechts aus, infolge der chemischen Thätigkeit und elektromotorischen Kraft, die durch den Schnitt erregt worden sind. Man beachte, dass dieser Versuch, im strengsten Sinne des Wortes, eine Vivisektion ist. Für unseren Zweck muss die Kartoffel lebendig sein. Die Wirkung bleibt vollständig aus, wenn die Kartoffel durch kochen getötet worden ist." [1]

He then proceeds to give an account of a considerable number of experiments contradictory of the above statement. Prof. Adami, of Hof, did not use unpolarisable electrodes. but copper pins. It is not surprising that he should have failed to observe any signs of vegetable electricity.

Dr. Arthur Tompa, working in the Botanical and Physiological Institutes of the University of Halle, under the direction of Prof. Bernstein and Prof. Klebs, and with the advantage of the knowledge and experience of Dr. Tschermak, quotes on p. 100 [2] the ten headings of my communication at the Turin Congress on Vegetable Electricity, and quite correctly selects for reinvestigation as being the general and most important topic, paragraph 5, "The Electrical Response as a Measure of 'Vitality.'" He devotes much time and care to this reinvestigation, and somewhat reluctantly comes to the conclusion that Waller's blaze reaction is a fallacy arising from the fact that Waller has followed erroneously the direction of current. He devotes a diagram and a page of description, p. 104,[3] to his hypothesis in explanation of this imaginary blunder. I do not think that I have mistaken the direction of current, or that Dr. Tompa could have supposed that I was liable to do this if he had been at the pains to look at any of the diagrams in any of the papers of mine that he quotes.

Dr. Tompa should also have noticed in any of these papers that I have always spoken of excitation by induction currents and by condenser discharges. He has used the direct current of one or more Daniell cells. I have never done this for the reason that such currents give predominant polarisation counter-currents on living and on dead tissues alike. The blaze

[1] Sonderabdruck aus dem ii. *Bericht* des nordoberfrankischen Vereins für Natur-Geschichts- und Landeskunde.

[2] A. Tompa, *Beiträge zur Pflanzlichen Elektricität* ("Botanisch. Beiheften," original arbeiten).

[3] *Idem Ibid.*

reaction, whether unequivocal (homodrome) or equivocal (antidrome) requires short strong currents for its manifestation. I have therefore always used induction shocks and condenser discharges, as stated even in the extremely brief Turin abstract quoted by Dr. Tompa.

I shall be surprised if Dr. Tompa does not repeat the experiments, and from the courteous tone of his account of the matter I think it probable that he will withdraw his stricture on my work when he has witnessed for himself the clear and indubitable results of the experiments.

Can Carbon Dioxide be "Vitalised"?

THERE has long been present in my mind an idea to which I have hitherto hardly dared give expression. The query forming the above heading amounts to the raising of the question whether the carbon dioxide which is exhaled as a product of animal or vegetable vital processes differs in any way from the carbon dioxide of "inorganic" origin formed, let us say, from carbon by combustion in oxygen. The answer will probably be in the negative, since, on theoretical (stereochemical) grounds, an asymmetric structure is not possible in the case of this molecule. Nevertheless, it might be worth while to cross-examine nature on this point. It is, in fact, possible that the experiment may have been already tried with negative results, and that is why I venture into print, since I have been unable to find any record. Two ways occur to me for submitting the question to the test of experiment. Calling the carbon dioxide from the two sources "inorganic" and "organic" respectively for the sake of brevity, the "organic" gas might be obtained either from the brewer's vat or from a carbonate formed from the carbon dioxide of animal respiration. The rate of absorption of this gas might be carefully compared with the rate of absorption of a specimen of "inorganic" gas by a growing plant. This is a method which appeals to vegetable physiologists. The other method, which is more purely chemical, depends upon our being able to obtain some optically active compound sufficiently basic to absorb carbon dioxide. I cannot call to mind any such compound at the present moment, and from where I am writing I have no access to the usual sources of information. Given, however, an optically active base capable of forming a carbonate, would the gases from the two sources be absorbed at equal rates? Perhaps some of your readers may be able to dispose of these queries offhand. R. MELDOLA.

Easton Park Cottage, Dunmow, September 13.

Effect of a Lightning Flash.

DURING the storm on Wednesday, September 10, a house opposite my rooms in Fulham was struck by lightning at 4.40 p.m. Curiously enough, at the moment of the occurrence I was looking at the exact spot, and it may be of interest to record what occurred. A stack of brickwork about ten feet high capped with two red-pot chimneys about three feet high was struck, and a hole was made in the slates of the roof on the south side of the stack. One chimney was shattered. The flash was extremely brilliant and left a perfectly straight line of light on the retina; the length of the flash appeared to be twenty feet, but its upper part was lost in the diffused daylight. The flash was of several seconds' duration and was followed by a thin column of smoke; both these facts are due in my opinion to the fusion of the soot in the chimney. The flash itself was a mere line, otherwise the appearance of the whole strongly reminded me of a cordite discharge from a big gun. There was a loud report, and the circumstances left little doubt in my mind that the electrical discharge was upwards in direction.

C. DAVIES SHERBORN.

Bipedal Locomotion of a Ceylonese Lizard.

I HAVE frequently observed with interest the erect attitude assumed by the small Agamid lizard *Otocryptis bivittata*, Wiegm., when running rapidly, and have long suspected that the short front legs were not used at such times. But the rapidity with which the animal runs, and the nature of the ground which it usually frequents, have prevented very close observation. I have, however, recently fully satisfied myself that its action is truly bipedal. The lizard happens to be common in the Botanic Gardens here, and on several occasions one of them has crossed a smooth sanded road immediately in front of me. I have thus been able to see clearly that the anterior limbs are carried quite free from the ground, progress being effected solely by the long hind limbs.

It seems possible that the closely allied and similarly built lizard *Sitana ponticeriana*, Cuv., may have the same habit. Does the Indian species of Otocryptis (*O. beddomii*) progress in the same fashion?

At present the habit has been recorded only of one or more Australian lizards, notably the "frilled lizard" (*Chlamydosaurus kingi*), which has been very cleverly photographed in the erect attitude by Mr. Saville Kent. E. ERNEST GREEN.

Peradeniya, Ceylon, August.

A Series Related to Bernoulli's Numbers.

THE following seems to be a useful and interesting series:-

$$\frac{r}{r+1}=\frac{D_1}{r+1}+\frac{D_2}{\lfloor 2}+\frac{rD_3}{\lfloor 3}+\frac{r(r-1)D_4}{\lfloor 4}+\ldots\ldots\ldots\ldots+\frac{r(r-1)\ldots(r-p+3)D_p}{\lfloor p}+\ldots+\frac{r(r-1)D_{r-2}}{\lfloor 4}+\frac{rD_{r-1}}{\lfloor 3}+\frac{D_r}{\lfloor 2},$$

where

$$D_r=1;\quad D_{r-1}=\tfrac{1}{2}=3B_1;\quad D_{r-3}=-\tfrac{1}{6}=5B_2;\quad D_{r-5}=\tfrac{1}{6}=7B_3;\ \&c.,$$

and generally for all odd values of $p>1$,

$$D_{r-p}=-\left\{(-1)^{\frac{p+1}{2}}\right\}(p+2)B_{\frac{p+1}{2}},$$

B_1, B_2, . . . being the numbers of Bernoulli.

Also

$$D_{r-2}=D_{r-4}=D_{r-6}=\ldots=0.$$

I have been trying since last year, without success, to ascertain whether this is a known series previously published. If it is, perhaps some of your readers will be good enough to supply a reference. J. R. SUTTON.

Kenilworth, Kimberley, August 7.

FREDERICK AUGUSTUS ABEL.

THE death of Sir Frederick Abel on Saturday, September 6, at the age of seventy-five, removes a conspicuous figure from the world of science and technology and brings to a close a long and useful public career. For some years he had been in failing health, but his sudden death, which came painlessly from cardiac failure following one of those attacks of shivering and rigor to which he had long been subject, was quite unexpected.

Frederick Augustus Abel was born in 1827, being the son of Mr. J. L. Abel, of Woolwich. The family, which appears to have been of Swedish origin, had already produced men notable in science, music and painting. Abel has given in the Hofmann memorial lecture, which he delivered to the Chemical Society in 1893, an amusing account of his unsuccessful attempts in the early 'forties to learn chemistry at the Polytechnic Institution of those days; and these recollections perhaps impelled him in the efforts he subsequently made to improve the quality of technical education in this country. In 1845, he entered the Royal College of Chemistry as one of Hofmann's first pupils, and was soon promoted to be an assistant, which he remained until 1851, when he was appointed professor of chemistry at the Royal Military Academy at Woolwich, succeeding Faraday in this position. In 1854, he became chemist to the War Office, a post which he held until 1888, when he retired under the regulations of the Civil Service. It was during this period of thirty-four years that he made his